# Germinating ideas

**Compiled by the CSD Extension and Development Team**

WELCOME to Germinating Ideas. In this edition we discuss the impact of boll weight on yield and boll factors within the current commercial CSD varieties.

As bolls begin to open, thoughts should start to turn towards yield potential. Boll factors are one way to estimate yield potential, but they can also be notoriously misleading. This season, we are seeing a diverse range of crops with climatic impacts throughout the season, cool temperatures persisting in the south, while a lack of rainfall is an ongoing problem for most of Queensland. Added to this variability is the different forms of planting, from fully irrigated with varying levels of row configurations and water stress.

Boll counts are often inaccurate yield indicators. As a rule of thumb, 12 to 14 bolls per metre equates to 1.0 bale per hectare in irrigated, and 16–20 bolls per metre equates to 1.0 bale per hectare in dryland situations. Every season there is variability in the relationships between boll number and final yield, and there are many reasons why this occurs: In-field variability and representative sampling are probably the biggest reasons. With the advent of satellite imagery, drones and yield monitors on pickers, growers have become very aware of how much yield can vary within a field.

**NDVI Image of a cotton field near Wee Waa.**

While boll counts made on two to three metres of randomly selected plots in fields provides a good yield prediction for the area sampled, it may not be a representative measurement of the whole field. Growers and agronomists have addressed this by using precision agriculture tools such as EM surveys and yield maps from previous crops to identify areas that are representative of the majority of the field.

These techniques are also used for locating moisture probes, tissue testing and in-season plant monitoring. Boll weights can vary greatly, and hence will impact on how these numbers convert to yield. Table 1 illustrates how 50 per cent variation in boll weight equates to 50 per cent variability in yield with the same boll numbers. These levels of boll weight variability have been observed within the same variety in CSD's segmented picking work over many seasons.

**TABLE 1: Impact of boll weight and boll number on yield potential**

| | | Boll weight (g/lint per boll) | | | | |
|---|---|---|---|---|---|---|
| | | **1.6** | **1.8** | **2.0** | **2.2** | **2.4** |
| **Bolls/m** | 80 | 5.7 | 6.4 | 7.1 | 7.6 | 8.4 |
| | 100 | 7.1 | 7.9 | 8.8 | 9.6 | 10.6 |
| | 120 | 8.4 | 9.6 | 10.6 | 11.6 | 12.6 |
| | 140 | 9.9 | 11.1 | 12.3 | 13.5 | 14.8 |
| | 160 | 11.3 | 12.6 | 14.0 | 15.5 | 16.8 |
| | | **Yield (bales/ha)** | | | | |

Yield (bale/ha) Boll factors, as displayed on *www.csd.net.au/boll-factors*, provide an indication of how many bolls per metre are required to produce 1.0 bale per hectare. For each boll factor, there may be up to 33 per cent variability from the upper and lower limits in the original data as shown in the example in Table 2.

**TABLE 2: Sicot 74BRF example highlighting the range in yield dependent on boll factor**

| | **Mean** | **Upper** | **Lower** |
|---|---|---|---|
| Boll factor | 13.5 | 12.0 | 16.5 |
| Yield (bales/ha) | 11.1 | 12.5 | 9.1 |

Boll factors provide a good indication of the comparative boll weights between varieties. If everything else is equal, a variety with a lower boll factor will achieve a higher yield than a variety with a larger boll factor with the same boll counts. Additionally, there are regional, seasonal and stress related impacts which can alter the relative boll factors. For example, during the 2019–20 season some regions experienced a boll shed event as a result of prolonged overcast conditions; although the rain event did provide some with the opportunity to grow crops on. Late set bolls will often be smaller than early set fruit as they do not have the amount of time to mature. The net effect of a higher proportion of late fruit with lower weight is an increase in the number of bolls required to make a bale.

**TABLE 3: Boll weights and boll factors**

| Variety | Boll factors | |
|---|---|---|
| | Irrigated | Dryland* |
| **2017–18 SEASON** | | |
| Sicot 714B3F | 11.95 | 15.46 |
| Sicot 746B3F | 11.74 | 16.56 |
| Sicot 748B3F | 11.34 | 16.39 |
| Sicot 754B3F | 12.16 | 13.16 |
| Sicot 707B3F | 12.41 | 13.07 |
| Sicot 711RRF | 12.01 | 12.17 |
| Sicot 812RRF | 12.06 | 12.16 |
| **2018–19 SEASON** | | |
| Sicot 714B3F | 12.84 | 23.12 |
| Sicot 746B3F | 12.44 | 20.92 |
| Sicot 748B3F | 12.03 | 23.12 |
| Sicot 754B3F | 12.94 | 20.85 |
| Sicot 707B3F | 12.57 | 19.03 |
| **2019–20 SEASON** | | |
| Sicot 714B3F | 14.33 | Very limited data generated from season in the CSD Ambassador or Variety trial programs |
| Sicot 746B3F | 13.55 | |
| Sicot 748B3F | 13.39 | |
| Sicot 754B3F | 13.04 | |
| Sicot 707B3F | 14.47 | |
| Sicot 606B3F | 14.56 | |

Cotton Seed Distributors Ltd 2021.
Note: Dryland bolls per metre shown in linear metres.

## Why boll weights vary

Final boll weight is influenced from the time a square is initiated to the time the picker reaches it.

### More seeds/boll = heavier bolls

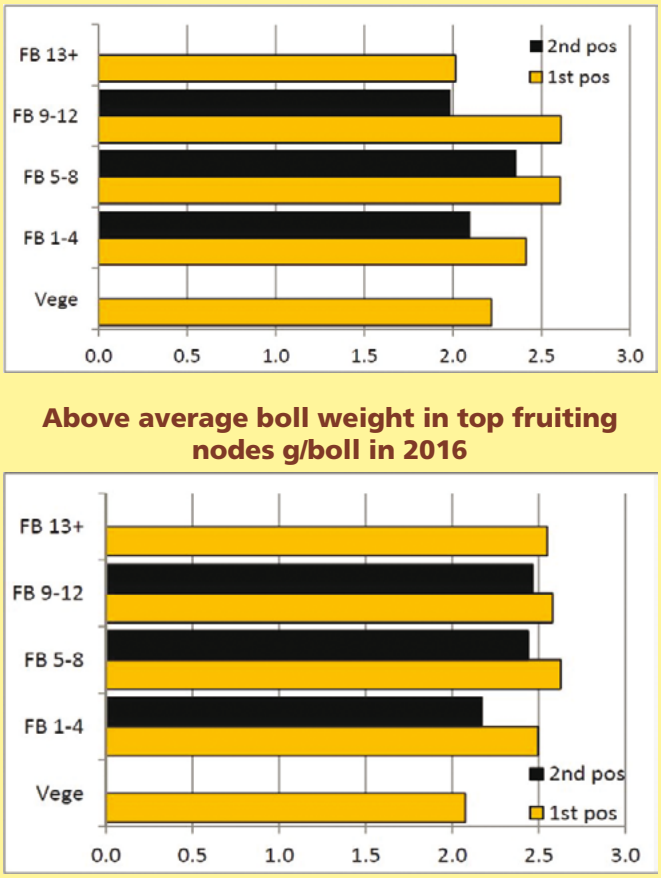
The time between square initiation and flowering is three to four weeks. The number of ovules (that may become seeds) is determined just after the point of square initiation. The ovule number is largely influenced by the genetics of the variety, crop stress and nutrition. The square is particularly sensitive to environmental stress (e.g. heat/moisture) at this stage. As a rule of thumb, healthy crops have between 30–35 seeds per boll with some bolls having up to 40.

White flowers open at dawn and are usually pollinated in less than eight hours. Fertilised ovules go on to become seeds, while those not fertilised are known as motes and these may produce a short fibre that is removed through the ginning process. The number of ovules fertilised is strongly influenced by environmental factors especially night time temperature, with high (over 25°C) night time temperatures being detrimental.

### More lint per seed = heavier bolls

Larger seeds will have more lint per seed. Other than genetics, the causes of this are not well understood, but competition between seeds in a boll is likely. The weight of each fibre is determined by the growing conditions from flowering onwards. Things that can influence this include nutrition, climate, boll load and location on the plant.

**FIGURE 1: CSD segment picking data – normal boll weight distribution versus 2016 boll weight distribution**




- Moisture stress during boll fill needs to be severe before it will limit boll weight. Bolls are less sensitive to stress than leaves, hence boll growth can still occur after vegetative development (eg. new nodes) has stopped.
- Crops with low boll numbers can have higher boll weights as there is less fruit to draw on the plant's photosynthetic resources.
- First position bolls are usually heavier than second position bolls and those on vegetative branches. On the main stem, heaviest bolls usually occur around fruiting branches 4–7, and decrease towards the top of the plant as there is more competition for assimilates. Bolls at the bottom of the plant often suffer from shading, this obviously being worse in rank crops. The size of a boll is proportional to the size of the subtending leaf.

Figure 1 shows an example of the normal distribution by boll weight in a crop versus the 2016 crop, where due to a prolonged summer, bolls were able to develop well into March and were heavier than normal in top fruiting nodes, meaning for more overall yield as was observed.

**For further information in relation to any of the topics mentioned in this article, please contact your local CSD Extension and Development Agronomist or visit the CSD website.**